

Guided to Urban Water, Energy and Solid-Waste Management Challenges and Solutions, Hashemite Kingdom of Jordan

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Abstract

Jordan, a primarily desert country in the Middle East, is located in a region of political instability generating enormous masses of permanent refugees and high population growth. It is severely challenged by, among many issues, its water, energy, and solid-waste management problems: severe water scarcity, high energy costs and import dependency, and no properly managed solid-waste infrastructure. There are several short-term, mid-term, and long-term potential solutions to Jordan's rapidly increasing urban water and energy demands and solid-waste generation from non-agricultural and non-industrial activities. It would be wise to have an ongoing national dialogue to identify and assess current or baseline conditions, envision a mission going forward, and detail the visions of where the country wants to be and how to get there in terms of these urban water, energy and solid-waste challenges over short, medium, and long terms.

Some key components of long-term solutions include:

- Improved social marketing, water and energy conservation, co-energy generation, artificial groundwater recharge and treated wastewater recharge basins and dry surface reservoirs
- Transnational water and energy cooperation and transfers
- Exploration and development of national water and energy resources, including deep groundwater, desalination of mineralized springs and well water, wastewater collection and treatment and reuse, and of course tapping national wind, solar, oil and gas, and geothermal resources
- More expensively, there are geothermal and hydropower opportunities, nuclear energy, and the Red-Dead and/or Med-Dead water and energy potential
- Solid-waste will need the infrastructure, laws, regulations, ordinances, and incentives with public support to reduce, reuse, recycle, compost and waste-to-energy initiatives from what is now considered disposal trash or garbage
- Energy generation from organic wastes such as food wastes, crop residues, and wastewater treatment plant biosolids or sludges to methane gas as a sustainable renewable energy source

Introduction

Jordan is fortunate to have a cohesive and well educated, modern society, with political stability, a long-standing water-exchange and peace treaty with its natural-gas exporting and high-technology neighbor to its west, and abundant sunlight and enormous, largely unexplored land mass for oil, gas, and geothermal resources, and great topographic relief, with access to the Red Sea to its south. Unfortunately, the country is located in a region of political instability generating enormous masses of permanent refugees. In addition, generous international donors and investors are attracted to the country, and urban Jordanians have a long-term history demonstrating their willingness to pay for municipal services. It also has the potential for strong economic growth in agriculture, tourism, and mineral resources development which would give it more flexibility in water, energy and solid-waste management infrastructure programs.

There are several short-term, mid-term and long-term solutions to Jordan's rapidly increasing urban water and energy demands and solid-waste generation from non-agricultural and non-industrial activities. It would be wise to have an ongoing national dialogue to identify and assess current or baseline conditions, envision a mission going forward, and detail the visions of where the country wants to be and how to get there in terms of these urban water, energy and solid-waste challenges over short, medium, and long terms.

Urban water and energy demand management through rationing, pricing, public private partnerships, utility privatization, community based and local user associations in water and energy, and integrated water or energy resources management with large water and energy uses in other sectors, improvements in water and energy transmission and reduction of non-revenue water and energy, or course are helpful, but resource limiting. Even with the most optimistic social marketing, pricing and regulatory scenarios at say at full 100% national cooperation, it's unlikely that these measures in total can be more effective in saving more than 30 to 50% of energy and water demands per capita, respectively. Meanwhile, as the urban populations and refugees rapidly increase, new water and new energy resources are required.

Jordanian Background in Water, Energy and Solid-Waste Management

Institutional Setting

The Hashemite Kingdom of Jordan is a stable, democratically prone, modern parliamentary monarchy. At its highest level, Government of Jordan (GoJ) is administrated by the Council of Ministers.

"I am delighted to see that more and more Jordanians embracing the spirit of 'active citizenship.'" Al Hussein, Abdullah II ibn, September 14, 2014. **Goals, Achievements and Conventions: Pillars for Deepening Our Democratic Transition.** The Jordan Times, Vol. 39, No. 11825, p. 3. "

The Jordan Times, September 14, 2014. **His Majesty outlines approach to further enroot democratic principles in public life.** The Jordan Times, Vol. 39, No. 11825, p. 1&13.

Several key ministries for water, energy, and the environment are:

Ministry of Water and Irrigation (MWI) and its Water Demand Management Unit (WDMU) and its Water Demand Management System (WDMS) and MWI's Information and Communications Technology Unit (ICTU) and National Master Planning Unit (NMPU); funded by USAID, German Development Bank (KfW), Gulf Cooperation Council (GCC), Kuwaiti Fund for Arab Economic Development, Saudi Fund for Development; United Arab Emirates (UAE) and Qatar, supports Water Wise Women's Initiative (WWWI) and supports the Jordan Water Company (Miyahuna), Aqaba Water Company (AWC), Yarmouk Water Company (YWC); MWI's Best Management Practices (BMP) training program; Water Use Efficiency (WUE) Master Plans developed by Miyahuna, AWC and YWC.

Ministry of Water and Irrigation (MWI) is the official body responsible for the overall monitoring of the water sector, water supply and wastewater system and the related projects, planning and management, the formulation of national water strategies and policies, research and development.

Since its establishment, MWI has been supported by several donor organization projects that have assisted in the development of water policy and water master planning as well as restructuring the water sector. The Ministry of Water and Irrigation embraces the two most important entities dealing with water in Jordan:

The Water Authority of Jordan (WAJ): in charge of water & sewage systems. The Jordan Valley Authority (JVA): responsible for the socio-economic development of the Jordan Rift Valley, including water development and distribution of irrigation. This relative position with respect to WAJ & JVA reinforces MWI's leading role as Jordan's lead entity on water issues.

Ministry of Energy and Mineral Resources (MEMR) with its strategic energy plan, which often collaborates with the National Electric Power Company (NEPCO), National Petroleum Company (NPC), Noble Energy, British Gas Group, Department of Lands and Survey, Energy and Mineral Resources Regulatory Commission, Jordan Atomic Energy Commission, Jordan Electric Company (EDECO), Irbid Electric Company (IDECO), Electricity Regulatory Commission (ERC), Attarat Power Company, British Petroleum; and Renewable Energy Law

Hashemite Kingdom of Jordan, December 2007. **Summary, Master Strategy of Energy Sector in Jordan for the Period 2007-2020, First Part.** 26 p. The strategy recommends several actions in oil, electrical power, natural gas, renewable energy, energy consumption efficiency, oil shale exploration and development, and alternative energy sources.

Ministry of Environment (MoEnv) (and its several initiatives to protect and sustain the Kingdom's environment and natural resources, including a wastewater treatment project, a capacity-building project under which the ministry prepared the draft environmental protection law; launched the Environmental Inspection Audit Policy; and initiated plans to rehabilitate the phosphate hills) Jordan Food and Drug Administration (banned plastic food bags); its Environmental Ranges (for enforcement); funded by U.S. Millennium Challenge Corporation as a MCC Compact State, King Abdullah II Fund for Development (KAFFD), Society for Conservation, United Nations Development Programme (UNDP); and Environmental Strategy Report, draft Environmental Law, Environmental Inspection Audit Policy

Ministry of Education (abbreviation MoE)

Ministry of Tourism and Antiquities (MoTA?)

Ministry of Public Works and Housing (MoPWH)

Ministry of Industry and Trade (MoIT)

Ministry of Planning (abbreviation MoPIC)

Ministry of Interior (abbreviation MoI)

Ministry of Public Sector Development (abbreviation MPSD?)

Ministry of Communications and Information Technology

Ministry of Finance (MoF), especially water and energy subsidies

Ministry of Religion (Awkaf and Islamic Affairs), especially its role in social marketing

Note the Royal Scientific Society and Jordan Standards and Metrology Organization (JSMO set codes, standards, and practices, and certifies equipment and materials.

Other players, such as United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), German Jordanian University, Jordan University, Jordan University for Science and Technology (JUST), Vocational Training Corporation (VTC), National Employment Training (NET), King Abdullah II Center for Excellence (KACE), Aqaba Special Economic Zone Authority (ASEZA).

British Broadcasting System (BBC), September 17, 2014. **Syrian refugees now comprise 20 percent of the Jordanian population.**

Some key planning documents are:

National Water Master Plan. A digital National Water Master Plan was launched in 2004 by the GoJ. It is an integrated plan that enables decision makers to set policies and strategies based on planning scenarios derived from sectoral water consumption trends. The Master Plan is based on the Water Information System (WIS) which contains monitoring data related to demands and resources.

National Water Strategy. In May 2009, King Abdullah gave the go-ahead for a National Water Strategy until 2022. The strategy includes investments of Jordanian Dinar 5.86B (US\$8.24B) over 15 years, corresponding to more than 160% of Jordan's GDP. It foresees a decreasing reliance on groundwater from 32% in 2007 to 17%, increased use of treated wastewater in agriculture from 10% to 13% and increased use of desalination from 1% to 31%. According to then-Minister of Water, Raed Abu Soud, even after the completion of the Disi Water Conveyance Project, the water deficit in 2022 will still be about 500 million cubic metres, highlighting the need for desalination under the Red Sea-Dead Sea canal. The strategy also envisages institutional reforms such as enacting a new water law, separating operational from administrative

functions, as well as production from distribution operations, creating a Water Council with advisory functions and establishing a Water Regulatory Commission.

The **Ministry of Environment** has developed a three year strategic plan for the years of 2011 to 2013. The plan encompasses seven strategic objectives, 12 policies, 19 programs and 60 projects. The objectives are as follows:

- Contribute to achieving sustainable development
- Develop policies and legislations
- Enforce the monitoring and inspection and compliance to rules and regulations
- Raise awareness on environmental concepts
- Enhance the collaboration at the national, regional and international levels
- Build the institutional capacity of the Ministry

USAID's IDARA's initiative to convince the utilities to each develop a Master Plan specific to water use efficiency (WUE) to promote WDM as one of the core businesses of each utility. Now the WUE plans are in place, and the utilities have started implementing the residential component of those plans with the support of WDMU and IDARA. Institutionalization of WDM in Jordan is highly dependent on the success of full implementation of the WUE plans of utilities. The utilities still need extensive technical support to implement their plans and capacity building to institute WDM. This should be one of the key high-priority tasks of IDARA to follow-up on.

Proposed Arab Marshall Plan, Jordanian National Economic Blueprint, National Communication Strategies and Action Plans, Support Aqaba's Business Plan, utilities Strategic Communication Plans.

The Jordan Times, August 22-23, 2014. ***Economic woes key challenge facing Jordan – King: National institutions capable of overcoming political, security threats; King urges private-public partnerships to draft, implement blueprint; Jordanians should believe in the economic plan in the first place.*** The Jordan Times, Vol. 39, No. 11806, p. 1&13.

In addition to national ministries and their subsidiaries, Jordanian governorates (that is, states or provinces) have districts, municipalities and directorates, often with local level responsibility for environmental management and public health.

Water Issues

“Jordan today stands face to face with the reality of potentially frightening water shortages. In a largely arid region, even the slightest change in water levels or quality has a significant impact on agriculture, industry, nutrition, and personal health standards. The hard reality is that Jordan is consuming more water than it has available from secure (annually renewable) sources. A water catastrophe is imminent, as groundwater resources will slowly dry up.” Embassy of the Hashemite Kingdom of Jordan, Washington D.C. USAID Economic Development Program, 2007. ***Responding to the water crisis in Jordan.*** p.1.

Unlike industrialized countries in North America, Europe, Japan, Australia and New Zealand, developing countries typically have cash-run economies and severe limitations on internal capital accumulation, banking loans and bonds for infrastructure planning, design, construction, and operations and management. Consequently, such countries depend heavily on humanitarian assistance and international development grants and technical assistance projects from donors, religious organizations and non-governmental organizations (NGO). In Jordan, The Jordan Times (Ghazql, 2014; Infrastructure, 2014; Namrouqa, 2014) and other media routinely report on donor awards.

Obeidat, Omar, September 2, 2014. ***Jordan requests \$4.5B from donors as refugee burden grows - Kingdom ready with plan to unify humanitarian aid to Syrian refugees.*** The Jordan Times, Vol. 39, No. 11815, p.1&13.

The Jordan Times, September 15, 2014. ***AT A GLANCE: France to fund water projects in northern region.*** The Jordan Times, Vol. 39, No. 11826, p. 3.

Obeidat, Omar, August 17, 2014. ***‘Jordan hosts third largest number of refugees in the world.’*** The Jordan Times, Vol. 39, No. 11801, p. 3.

The Jordan Times, September 14, 2014. **ECONOMY: IMF [International Monetary Fund] team in town to assess economic reforms.** The Jordan Times, Vol. 39, No. 11825, p. 1&13. Assessing its 36-month Stand-By-Arrangement (SBA) of about \$2B or 800% of Jordan's IMF-approved quota.

This dependency creates a culture of reliance. It also gives donors and contributors leverage to attach and impose conditions for assistance, grants, loans and other support. For example, water-sector conditional assistance may include, for example: conducting water use and energy surveys, raising municipal water rates, permitting and monitoring irrigation water usage, inspecting and repairing municipal water distribution systems (especially leak detection and repair), improving municipal water quality and reliability, enhancing watershed protection and pollution prevention, eliminating pirated municipal water, and promoting water awareness, sanitation, conservation and reuse. Energy sector conditional assistance may include, for example: phasing out of fossil fuels with more renewable solar and wind energy sources, replacing large motors with variable speed and highly efficient motors, conducting energy use and efficiency surveys, supplying energy-efficient appliances and other devices and equipment, and promoting sustainable energy awareness and practices. Solid-waste sector conditional assistance may include, for example: conducting solid-waste inventories and surveys from source to grave, funding small business or NGO reuse and recycling activities such as soft-demolition product sales and valuable resources (metals, paper, cardboard, glass, paper, rubber, vehicle parts, and electronic and appliance equipment) commodity recovery purchases, and promoting Smart Shopper Programs in the hierarchical 3R's (reduce, reuse and recycle).

Water costs have been high in Jordan for decades, and prices rise in part to increased energy costs, especially as Desi Aquifer water from far southern Jordan has come online to Amman. The Jordanian government subsidizes these costs to the amount of JD345.2M in 2013 (Economy, August 14, 2014. **'Over JD2.2B spent on subsidies last year.'** The Jordan Times, Vol. 39, No. 11799, p. 1&13).

"However, at home we try not to use too much water. It's good for us because we need water; we don't need to keep it one when you wash yourself. You save money. My mother cares about these issues. Here in Jordan, there's not much water. Don't let the faucet run when washing the dishes. Use a small stream of water. I live in a house and take short showers. We collect rainwater from the roof for plant water. For energy, we turn off lights, also when watching TV. We don't dry clothes in a dryer but on a clothesline by air dry. We don't do trash separation, just combine everything." Hotel VIP leader

The Jordan Times, September 15, 2014. **AT A GLANCE: Over 162,000 families receive fuel compensation.** The Jordan Times, Vol. 39, No. 11826, p. 2.

In addition, donors may promote conditions which are cross-cutting or pillar, such as: utility transparency, gender and disabled/ handicapped access and equity, youth involvement, community participation, extending services to underserved populations and communities, public-private partnerships (PPP), and even charging, collecting, and publicizing fees from municipal, governorate, regional, military, federal and other agencies and sectors which may be unaccustomed to paying for water, energy and solid waste services.

The water, energy and solid waste management sectors are somewhat intertwined as they each contribute to the others in some way. Jordan in modern times has been infamous as having the lowest per capita water supply of all countries other than a few African countries, yet has a rapidly expanding population fueled in part by waves of refugees from neighboring lands. In addition, mining of the Desi Aquifer by Saudi Arabia, damming of Jordan River headwaters by Syria, and unfavorable Jordan River treaty with Israel contribute to Jordan's perpetual water crisis (Brooks and Ozay, 2000. *Water Balances in the Eastern Mediterranean*. International Development Research Centre, Ottawa, Canada; DAI, 2003. *Jordan's Water Crisis: A Race Against Time*, DVD. Office of Water Resources and Environment, Amman. Prepared for USAID/ Jordan).

Arid lands issues

Namrouqa, Hana, August 19, 2014. **Arid Lands Academy to address challenges facing dry areas: Prince Hassan**

Water scarcity in Jordan is beyond severe. It is an emergency, a crisis continually worsening and limited the development of the country's human and economic capacity.

Annual Estimates	Jordan	West Bank/ Gaza	Saudi Arabia	Iraq	Lebanon	Syria	Turkey	Egypt	Israel
2011 Renewable internal freshwater resources per capita (cubic meters) *	110	207	86	1,108	1,095	325	3,107	23	97
2011 Electric power consumption (kWh per capita) **	2,289	NA	8,161	1,343	3,499	1,715	2,709	1,743	6,926
2013 Gross domestic product per capita (\$) ***	5,214	2,530	25,852	6,670	9,928	NA	10,946	3,314	34,619

Information sources:

* <http://data.worldbank.org/indicator/ER.H2O.INTR.PC>

** <http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC>

*** <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

Note: We can't verify the veracity or accuracy of these data. In general, wealthy countries have more options than less wealthy one; ready access to seawater also is an advantage for desalination. Saudi Arabia and Israel are wealthy nations; they each desalinate large-quantities of seawater to meet potable water demands; Israel treats and reuses large quantities of wastewater in agriculture; Egypt obtains its renewable water from rainfall in the Nile River Basin outside of the country. All but Gaza have ready access to sustainable seawater resources for potential desalination. Note Jordan's 1990 figure was 327 CM/year (Shannag, Esam and Yasser Al-Adwan Al-Adwan, 2000. **Evaluating Water Balances in Jordan**, in Brooks, David B. and Mehmet, Ozay, 2000, *Water Balances in the Eastern Mediterranean, Chapter 5*. International Development Research Centre, Ottawa, Canada, 2000).

The Jordanian National Water Strategy (http://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_Jordan) defines "water deficit" as "water demand" minus "water resources." "Water demand" is not used in an economic sense where demand depends on price. Instead demand is defined as water needs derived from policy objectives. Thus the figure given in the strategy for water demand in agriculture - 1,080 million m³ (MCM)/year - is far greater than actual water use of about 600 MCM/year. In 2007, agriculture accounted for 72% of "water demand," while the municipal share was 24% and the shares of tourism and industries were 3% and 1%, respectively. The water deficit of 565 million m³ (MCM)/year for 2007 thus is mainly caused by assumptions about "water needs" in agriculture.

The Strategy projects that municipal and industrial water needs will increase by 276 MCM/year from 2007 to 2022 (29+%), while agricultural water needs will stagnate. The Strategy envisages increasing water supply through three measures:

- more use of reclaimed water in agriculture and industry (+ 156 MCM/year),
- a net increase of fossil groundwater use (+ 59 MCM /year) through the Disi Water Conveyance Project to be completed in 2013, and
- the desalination of seawater as part of the Red Sea-Dead Sea Canal (500+ MCM/year) to be completed in 2022

Falkenmark (1989) stated that countries below the 1,700 m³/capita/year water-stress indicator should embark on a population control program to ensure long term sustainability of the nation.

Jordanian natural water sources are ultimately rain water which has sustained rivers and recharged groundwater in aquifers. Commonly, agricultural, domestic and industrial freshwater is obtained through deep wells or by desalination of mineral springs. Significant amounts of specialty agricultural, mining and other

processing water are obtained from treated wastewater some of which is desalted in part to reduce its salinity to make it suitable for irrigation.

Because of water scarcity and high-pricing responses, there are several serious unintended consequences in the Jordanian water sector. These generally are a result of the high water municipal water prices. These include: pirated urban water through unauthorized distribution pipeline connection which contribute to non-revenue water and raising municipal water utilities' operation and maintenance costs; illegal sales of agricultural water and other waters for domestic water use which may lead to sanitation and public health challenges; and, as a municipal residents are very water-conservation conscious, their municipal wastewater streams (Greater Amman) are amongst the highest in the world for biochemical oxygen demand, dissolved organic matter, and human waste salts. This latter consequence requires that Amman-treated wastewater requires some desalination to be used for crop irrigation due to its high salinity. Jordanians are world leaders in desalination and several water-conservation strategies such as rooftop rainwater harvesting, collection and reuse of air conditioning condensate for washing vehicles and watering house and street plants, treatment and reuse of wastewater for non-edible crop irrigation (landscaping, ornamentals, flowers, trees and tree crops) and Dead Sea mining and processing, innovative artificial groundwater recharge through dry surface reservoirs, and household grey water collection and reuse.

The majority of the pipes were illegally diverting water from mains either to private tankers or for filling tankers to sell water to people... in addition, some 400 illegal wells were sealed and scores of drilling rigs were seized. The Water Ministry banned the drilling of water wells in 1997 to limit random pumping of water and preserve aquifers from depletion and salinity. There are 1,138 wells of which more than 400 are unlicensed or illegal. Namrouqa, Hana, September 14, 2014. **'Over 11,000 illegal fixtures dismantled to combat water theft.'** The Jordan Times, Vol. 39, No. 11825, p. 4.

Over a decade ago, energy was very inexpensive in Jordan due to arrangements with its oil-rich, oil exporting neighbor, Iraq. But for several years, this energy source has not been available and Jordan struggles to meet its rapidly growing energy demands due to burdening population and demand for air conditioning, appliances, and electronics. High energy prices, like high municipal water prices, lead to several unintended consequences such as pirated energy or unauthorized connections. Jordan is rapidly moving toward energy-efficient lighting, cooling, and appliances.

Transparency or Economic Index	Jordan	West Bank/ Gaza	Saudi Arabia	Iraq	Lebanon	Syria	Turkey	Egypt	Israel
2013 Transparency Index * Rank of 177 countries/ Score of 100	66/ 45	NA	63/ 46	171/ 16	127/ 28	168/ 17	53/ 50	114/ 32	36/ 61
2014 Economic Freedom Index ** Rank of 178 countries/ Score of 100	39/ 69.2	NA	77/ 62.2	NA	96/ 59.4	NA	64/ 64.9	135/ 52.9	44/ 68.4

Information sources:

*Corruption Perception Index (CPI), Transparency International, www.transparency.org

**Index of Economic Freedom (IEF) - Promoting Economic Opportunities and Prosperity, www.heritage.org

Note: CPI ranks compared to all nations; scores "0" (very clean) to "100" (very corrupt). Ex. New Zealand ranks "1," scores "91;" North Korea ranks "177," scores "8"

Note: IEF ranks compared to all nations; scores 80-100 (free), 70-79.9 (mostly free), 60-69.9 (moderately free), 50-59.9 (mostly un-free), 0-49.9 (repressed). Ex Hong Kong ranks "1," scores 90.1; North Korea ranks "178," scores "1.0"

Amman delivers municipal potable water may be delivered only one day a week, but more often in some neighborhoods. This water is popularly considered non-drinkable but is used for washing and cleaning, while more expensive bottled water is purchase for domestic consumption – drinking and cooking. The situation is similar in other Jordanian cities. Municipal water in Madaba is often saline (>1,000 parts per million, total dissolved solids) during dry seasons from deep wells and colorful, turbid, silty, and sediment-rich during the rainy winter season from surface reservoirs which received soil erosion materials. When it rains and it might appear water would be plentiful, municipal water delivery is typically halted because its reservoirs are turbid and silty. Most urban, typically filter municipally supplied water through sand and/or activated carbon; some soften the water or perform reverse osmosis to reduce its hardness.



Metered municipal potable water generates revenue, and reduces water demand and bills. Jordan's 2011- estimated annual renewable water supply per capita is only 110 cubic meters, a third of what it was in 1990 and only 20% of what is considered "a main constraint to life" per the Falkenmark Water Stress Indicator (1989).





Inexpensive pipe-flow restrictors and faucet aerators or bubblers, and shower-head restrictors reduce household, hotel, office, and restaurant municipal potable water demand, and bills.





Small toilet-tank, dual-flush and low-flush toilets, and tank-leak dye tests and tank bags or bladders reduce municipal water demand and bills.





Missed opportunities to capture free rooftop rainwater or gray water for gardening, landscaping or car-washing use.



Because municipal potable water is rationed by delivery to water meters one every few weeks or once to a few times a week, Jordanian urbanites depend heavily on water-vender deliveries.



Municipal potable water is generally considered hard, contaminated, sometimes turbid and salty and unsafe to drink. Many Jordanian households have several-phase water treatment devices to filter turbidity, sediment, and bacteria through sand and activated carbon, and to reduce salinity by reverse osmosis desalination, making the delivered potable water suitable for cleaning and washing. Urban Jordanians typically drink only bottled water for safety sake.



Energy Issues

AT A GLANCE, Friday-Saturday, September 4-6, 2014. **Energy crisis a huge detriment to state budget - Rawabdeh.** The Jordan Times, Vol. 39, No. 11818. p.4.

Jordanian energy sources are typically imported fossil petroleum fuels as oil and gas, with much smaller amounts of local solar and wind power sources. Some households, many offices, and most restaurants, hotels and hospitals and high-rise and apartment buildings have back-up diesel generators to provide electricity when utility power is not available. Over a decade ago, energy came largely from Iraq at very low costs in exchange for Iraqi access to exporting networks. In recent years, however, energy costs have increased remarkably and are expected to rise by 15% annually for several years. The Jordanian government subsidizes energy to the amount of JD1.321B in 2013 (Economy, August 14, 2014. **'Over JD2.2B spent on subsidies last year.'** The Jordan Times, Vol. 39, No. 11799, p. 1&13). In addition, the government subsidizes gas cylinder for cooking at JD39.7M (Economy, August 14, 2014. **'Over JD2.2B spent on subsidies last year.'** The Jordan Times, Vol. 39, No. 11799, p. 1&13) The Jordanian government is actively pursuing potential programs in nuclear energy, oil and gas exploration, and importation of foreign oil and gas resources from neighboring countries.

At A Glance, Tuesday, September 2, 2014. **Amman sees highest electricity surge this summer.** The Jordan Times, Vol. 39, No. 11815, p.3.

"[As the hotel chief engineer], my hotel chain [and here in Jordan] has a lot of sustainability policies with a high value in sustainability. Energy is the most basic think on environment. It's our highest cost. Our goals are to lower energy by 30% from 2008 by 2020. We have energy audits. First was done in 2002/ 2003. We had many outcomes: some simple cost expenditures. Use of solar for heating pools. We use a liquid monofilament as an evaporation cover to our outside pool. Low-flow restrictors. Low-flush and dual-flush toilets. LED lights. Variable frequency [electrical motor] drives on air ventilation. Using liquid gas rather than diesel [to also reduce carbon footprint]. Recycling in guest rooms: separate recyclables to recycling company for the past 4-5 years. Segregated recyclables to local labor warehouse; sent to factories for paper, glass, etc. Garbage [from our] kitchen, banquets, and restaurants is separated; we work with local agencies for the needy so our food waste is not just dumped."

"[My hotel] has other environmental projects, like MAGC ('Make a Green Choice') and SME ('Sustainable Meeting Practices for the Environment Program'). SME puts in place all processes which will make meeting organizers, local transport (bicycles, buses, vans rather than cars), litter-free cables in meeting rooms, pens/ pads reused, digital signage instead of paper, no endangered species, no Styrofoam containers, encourage working with local suppliers to reduce transportation costs [and greenhouse gas emissions], green keeper supplies as programs." Jordanian Hotel Chief Engineer

"[In Jordan for sustainable environmental management, we are] limited by people's lack of education. Poverty is quite high. People think what's important to them, not what's important national environment. The whole area is so damn turbulent that you are always thinking of personal and family security. People are so frustrated by daily life challenges. People are not thinking about recycling. The hotel doesn't know if the vendors are actually recycling. UAE and Lebanon are advanced. Egypt, Syria, Saudi Arabia and Iraq are bad sustainables." Jordanian Hotel Chief Engineer

"[In Jordan] we are thinking not about sustainable environmental but about the people of Gaza and thinking about how to live. Stability in people's lives is needed for sustainability. Need to get the message right. Municipal water is delivered once a week. Disi Aquifer in the south need pumping and King Abdullah Canal at the surface reservoir needs management. Jordan water is very hard, high in calcium, leaves white deposits in boilers, heaters, pots and pans, human gall stones – big health problem in Jordan." Jordanian Electrical Engineer

"The hotel softens, electro-magnetic, desalinates by reverse osmosis, then ultra-violet treatments and residual chlorine [disinfectant of its delivered] potable water to meet international standards. We all drink bottled water. We all wash our cars several times a week because it is so dusty. One small water bucket can was four to five cars." Jordan Hotel Chief Engineer

"I built my family home 15 years ago. It captures rooftop rainwater for [subsistence vegetable] crops and [landscape] gardening." Jordanian Electrical Engineer

No Jordanian entity is an ICLEI (www.iclei.org) member for "local governments for sustainability," though several nearby cities from Israel, Palestinian Autonomous Authority, Saudi Arabia, and Turkey, are members. ICLEI promotes local government actions to reduce local greenhouse gas (GHG) emissions and urban heat island (UHI) effects through environmentally sound management (ESM) strategies and ordinances. Jordan is a member of the International Union for Conservation of Nature (IUCN, www.iucn.org). IUCN "helps the world find pragmatic solutions to our most pressing environment and development" concerning wildlife.

International Council for Local Environmental Initiatives (ICLEI), ***Best Practices for Climate Protection: A Local Government Guide: Reducing greenhouse gas emissions from local government buildings and operations.*** 36p.

"The main challenge facing the Jordanian economy in the last several years has been energy, but it is also the country's greatest opportunity as the field is filled with opportunities to attract foreign direct investment." Mansur, Yusuf, Tuesday, August 26, 2014. ***ECONOMIC REVIEWS: Jordan's lack of energy.*** The Jordan Times, Vol. 39, No. 11809, p. 9.



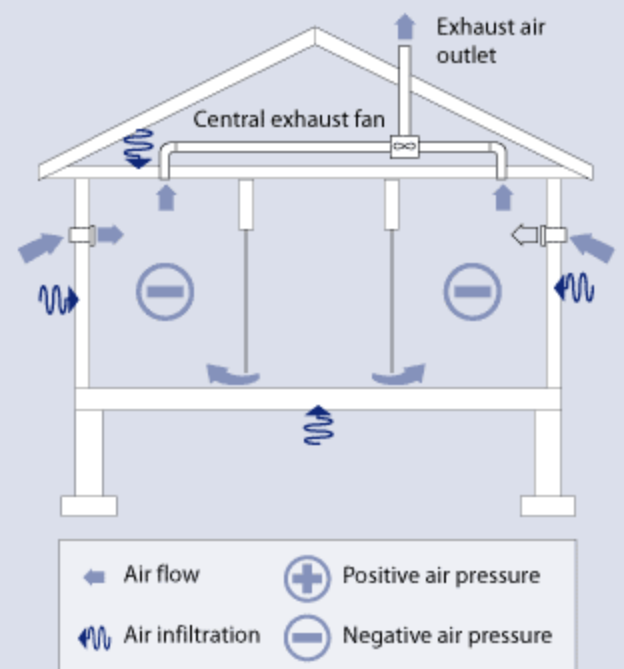
Metered electricity generates revenue, and reduces electrical energy demand and bills. Jordan's 2011-estimated annual electricity power consumption per capita is 2,289 kWh, or about 1.7 times that of Iraq, 0.65 times that of Lebanon, and 1.3 times that of Syria.



Compact fluorescent light bulbs, liquid-crystal device and light-emitting diodes are long-lasting, low-energy consumers which reduce electricity demand and bills.



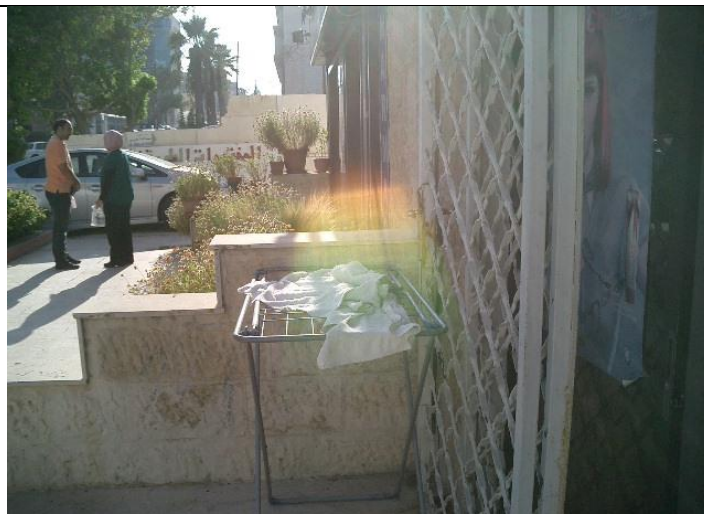
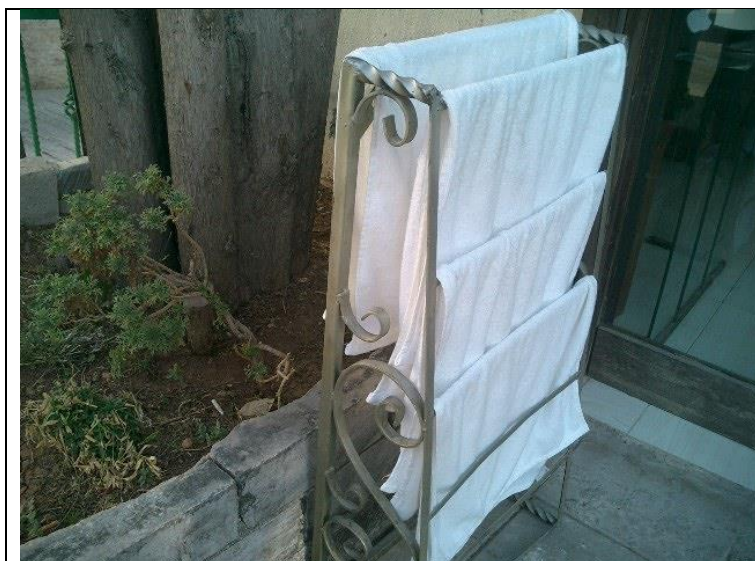
Exhaust Ventilation



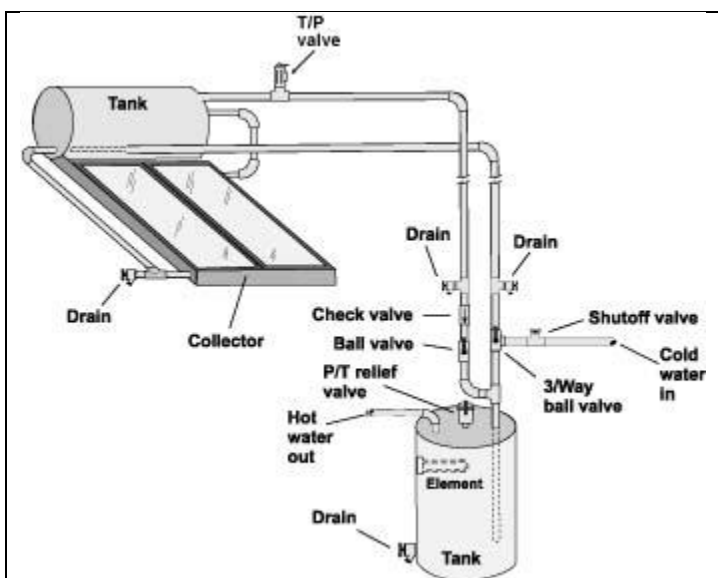
Low-cost energy-savings devices include roof-top cooling towers, wind turbines and heat exhausts, and sun-roof lights.



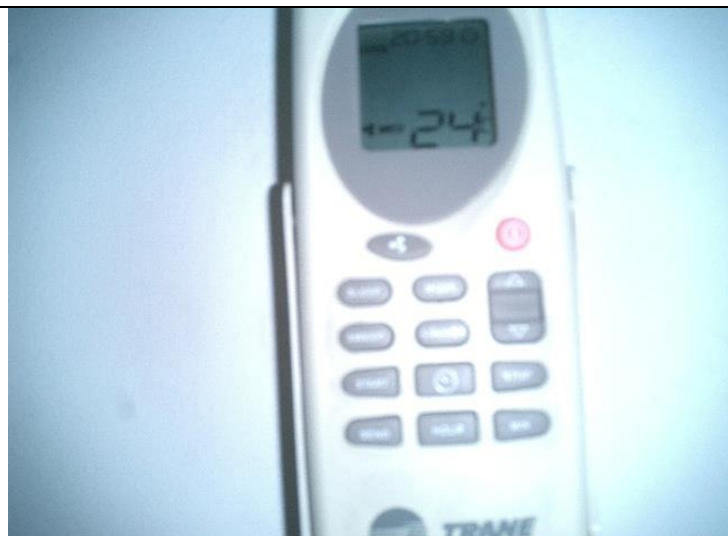
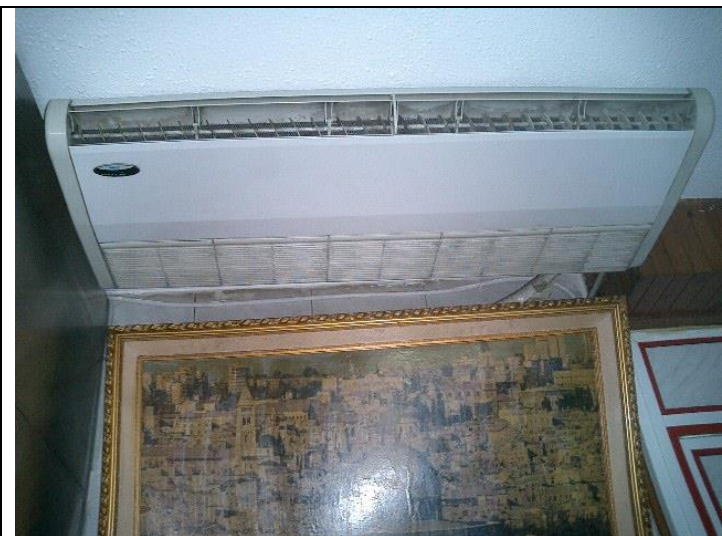
Light dimmers and turn-off-light stickers help reduce electrical energy demand and bills.



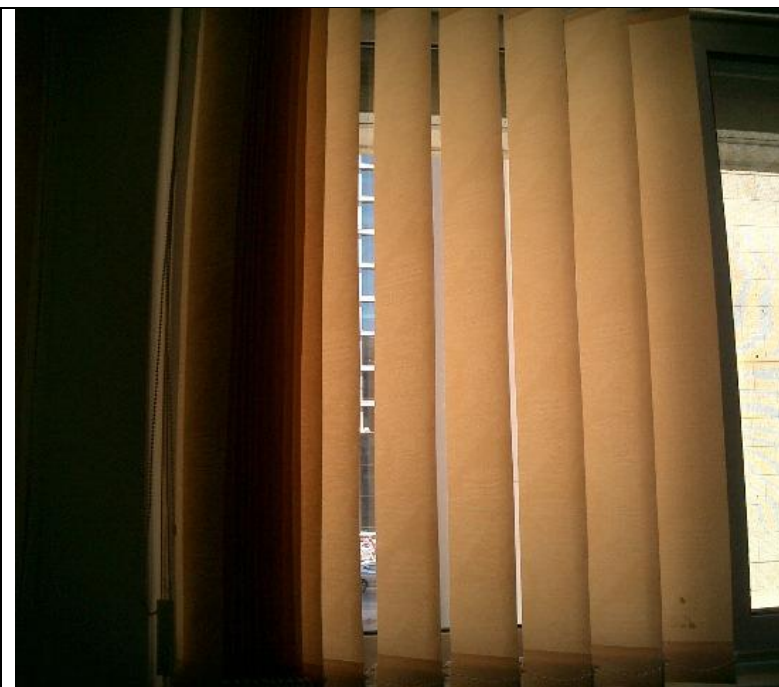
Household and commercial air-clothes drying, and hotel green choice program reduce electrical energy demand and bills.



Solar-water heaters are low-cost systems which reduce electrical energy demand and bills. They work best when the sun is out and when the solar collectors are clean and dust-free.

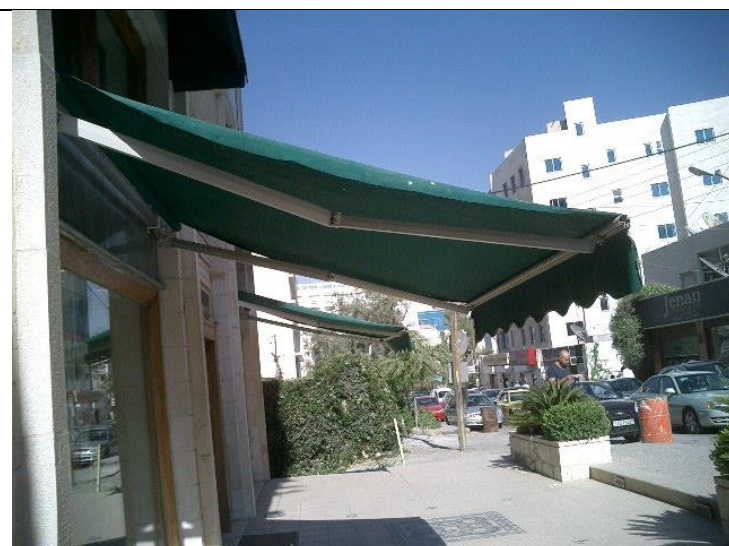


Room heating, ventilation and air conditioning systems are efficient and reduce electrical energy demand and bills, especially when controlled within recommended temperatures of about 24°C in summer and 20°C in winter.





Window blinds, curtains, and shutters, can be easily adjusted to allow sunlight but limit sun's heat to a room at low cost, reducing electrical energy demand and bills.





Awnings, tents, ramadas and other outdoor coverings provide shaded and cooler areas, reduce adjacent electrical energy demand and bills for air conditioning, and reduce urban heat island effects which add several degrees Celsius to outdoor ambient air and has adverse human health and discomfort effects.





Why do Jordanians wash their cars so frequently? Urban Jordanians wash or have someone wash their vehicles as many as three times a day to remove dust from construction sites and other sources. This dust, when it lands and builds up on solar panels or photovoltaic cells significantly reduces solar energy efficiency as in the non-functioning outdoor swimming pool hotel heater.



Urban shade trees reduce nearby building electrical energy demand and bills by reducing air conditioning demand. They also reduce urban heat island effect which adds several degrees Celsius to outdoor ambient air and has adverse human health and discomfort effects.

Black surfaces in rooftops, streets and parking lots add to urban heat island effects which add several degrees Celsius to outdoor ambient air and has adverse human health and discomfort effects, and increases electrical energy demand and cost for air conditioning.



Solid Waste Issues

Solid waste has always been a challenge where there are large Jordanian populations such as in Greater Amman, Irbid, and Aqaba. In general, source separation is not common for resource recovery although there is extensive informal collection by unemployed persons of aluminum cans, vehicle parts and other equipment for commercial recyclers. Unfortunately, Jordan currently lacks the infrastructure to find economic benefits in recycling of other metals, paper, cardboard, plastic, glass, rubber, tires, electronics, appliances, and food wastes (for composting and/or methane generation).

“Solid waste is a problem in Jordan. We don’t know how to get rid of it. Solid waste is a problem – garbage, medical waste.” Hotel Director of Business Relations

Medical wastes are especially problematic as they may spread diseases. There are many low-temperature medical waste burners but these are not as effective as properly operated and maintained, controlled, high-temperature incinerators. According to a UK mechanical engineer who consults to the MoENV, the only medical waste incinerator is poorly operated and maintained. Low-temperature burners and poorly operated incinerators convert plastics from solid-waste medical syringes, vials, tubing, and parts to carcinogenic dioxins and furans gases, and solid-waste metals to hazardous metallic vapors.

Namrouqa, Hana, Friday-Saturday, September 4-6. ***Conservationists raise alarm over Aqaba’s diminishing public***

beaches - Investment [construction] projects, littering also destroying coral reefs - JREDS. The Jordan Times, Vol. 39, No. 11818. p.2.

In some neighborhoods, thieves have been stealing iron doors and gates for resale and reuse, or to iron commodities brokers, especially in Madaba, indicating a commodities market for metals.

Jordanian typical solid waste includes construction debris, and commercial, industrial, agricultural and domestic or municipal and smaller amounts of hazardous and medical materials, much of which could be source sorted for reuse, recycling, or composting. Most Jordanian cities have informal scavengers who find, collect and sell discarded aluminum cans to commercial commodity brokers for recycling, but there is no large-scale reuse and recycling operations.

AT A GLANCE, Sunday, August 31, 2014. **SMS Service to inform motorists of traffic, littering tickets.** The Jordan Times, Vol. 39, No. 11813, p. 2.

Al Emam, Dana, September 9, 2014. **Authorities to ban use of plastic bags, food containers - Shops, bakeries to switch to paper, reusable fabric bags - JFDA [Jordan Food and Drug Administration].** The Jordan Times, Vol. 39, No. 11821, p.3.

The Jordan Times, September 11, 2014. **OPINION & ANALYSIS: Paper vs. plastic.** The Jordan Times, Vol. 39, No. 11823, p.8.

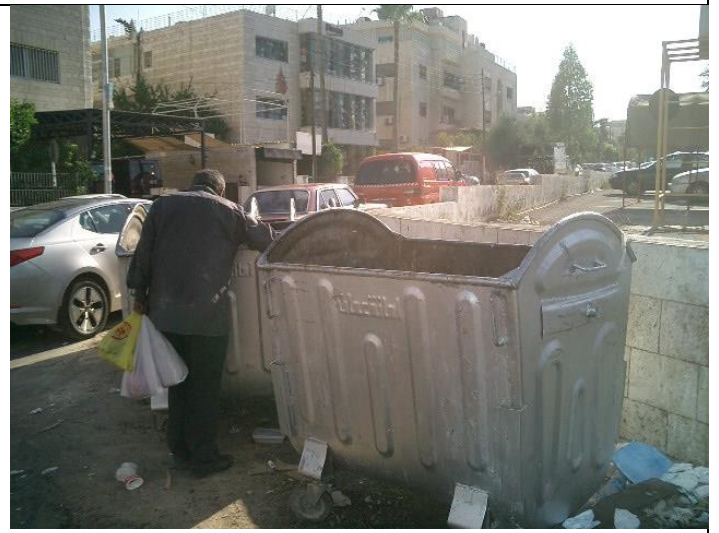




Recycling bins, containers and baskets offer the opportunity for resource recovery, reuse, and recycling if the infrastructure is there with materials commodity brokers and potential sustainable incomes and safe jobs.



Street garbage bins reduce street litter but attract vermin and disease vectors from its food wastes. If the infrastructure were provide for “dirty” materials recovery facilities (MRF) with connections to resource commodity brokers and organic waste to animal feed, or waste-to-energy , compost or fertilizer schemes, the opportunity for resource recovery, reuse, and recycling is feasible with potential sustainable incomes and safe jobs. Food wastes typically comprise 50 to 60% of household waste, and if separated, can provide sustainable methane gas to replace expensive imported diesel fuel and natural gas.





Discarded non-sanitary solid medical and animal waste as discarded used syringe, surgical glove, and condom, and dead-cat carcass present a human health and wildlife hazard on Suleiman Street near the MSI JMESP Office.

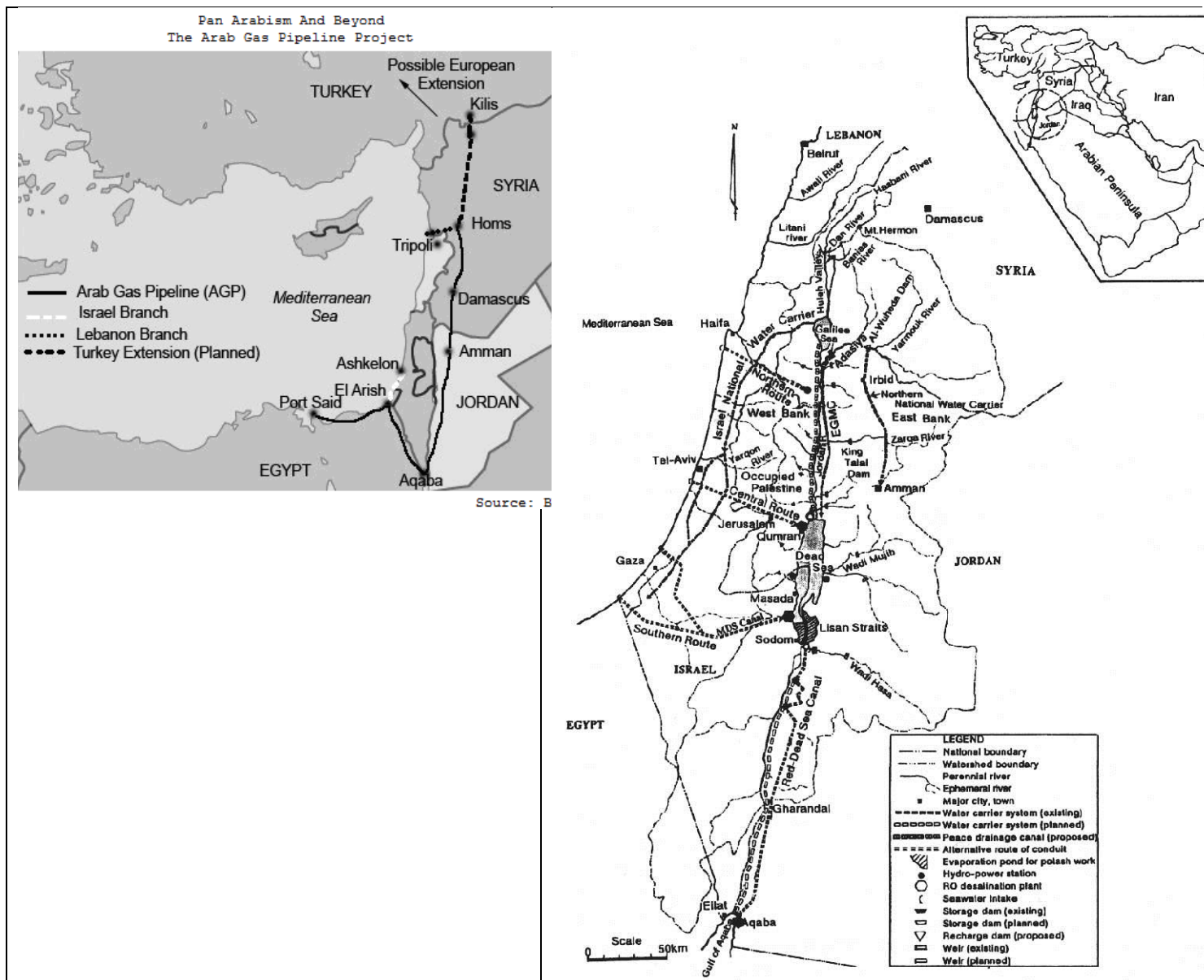
Some ideas for improvements in Jordan water, energy and solid-waste management practices: What more can be done?

Water

The Jordan Times, September 14, 2014. ***New water projects to supply north with 735-cubic metres per hour.*** The Jordan Times, Vol. 39, No. 11825, p. 2.

A wide-angle photograph showing a gravel road or embankment in the foreground, leading towards a large, layered mountain range in the background. The sky is overcast. The terrain is arid, with sparse vegetation visible on the left side of the road.





Many transnational or cross-border energy and water schemes have been proposed from the time of Napoleon onward, such as water transfer from Turkey-Lebanon-Syria-Jordan, Red-Dead and Med-Dead water canals and hydroelectricity generation from the great topographic relief, and even more oil-and-gas pipelines from various Mediterranean countries to Jordan. Though technically feasible, they will cost billions of dollars and require acceptance if not active cooperation between several countries with poor relationships.

Namrouqa, Hana, August 21, 2014. **'New \$45M wastewater pipeline to be build next year.'** The Jordan Times, Vol. 39, No. 11805, p. 3.

Namrouqa, Hana, September 10, 2014 . **'Zamam-like' water may be present in Northern Badia - Nasser.** The Jordan Times, Vol. 39, No. 11822, p. 2.

Hoffman, Tyler - A Strategy to Build a Freshwater Pipeline from Turkey to Jordan MACD, MIIS, Monterey, California 2003

USAID - Red Sea-Dead Sea Conveyance Feasibility Study and Environmental and Social Assessment (RS-DS WCFS-ESA), 2007

Energy

The Jordan Times, September 14, 2014. **Activists call on gov't not to proceed with Israeli gas deal.** The Jordan Times, Vol. 39, No. 11825, p. 4.



Clockwise: solar panel collector panels to run water-supply wells in northern Uganda; MENA wind energy turbine; geothermal energy heat-exchanger at International Village at Pristina, Kosovo; human wastewater-to-methane at Bangladesh boy's Madrasa; and animal farm waste-to-methane at commercial farm near Bangkok to reduce diesel or grid electric energy or natural gas demand.





Clockwise: The Cairo Zabelene school which teaches solid-waste resource collection and recovery, refuse and recycling as the economic basis for this large Zabelene community; Sour's unsorted garbage unloading area for its new "dirty" (unsorted) materials recovery facility (MRF), Lebanon; dirty" MRF, Lebanon; Aqaba's wastewater treatment plant which make compost for its wastewater bio-solids (sludge) and provides treated wastewater for landscaping, herbal and medicinal tree irrigation, and mining-processing water to replace fresh-water demand; Shell's food-scrape waste to commercial compost and fertilizer at urban Surabaya, Indonesia; Lebanon food-scrape waste to commercial compost

Nelmat, Khaled, August 28, 2014. **MPs criticize delays in implementing energy projects – Hamed says ministry's restructuring to speed up procedures.** The Jordan Times, Vol. 39, No. 11811, p. 3.

The Jordan Times, August 24, 2014. **Ministry of Energy & Mineral Resources: Announcements for MEMR International 2014 [Petroleum Exploration] BID ROUNDS "AZROQ BLOCK" and "DISCOVERY DEVELOPMENT AREA WITHIN WS-4 WELL," "SIRHAN BLOCK EXCLUDING THE DISCOVERY DEVELOPMENT AREA."** The Jordan Times, Vol. 39, No. 11807, p.7.

Ghazal, Mohammad, August 24, 2014. **Gov't invited bids to explore for oil, gas in northeast region.** The Jordan Times, Vol. 39, No. 11807, p.3.

Ghazal, Mohammad, August 17, 2014. **Energy: Jordan to buy gas from Gaza starting 2017 – minister: deal with British company to be signed later this year.** The Jordan Times, Vol. 39, No. 11801, p. 1&13.

Mansour, Yusuf, September 9, 2014. **OPINION & ANALYSIS: Gas from Israel.** The Jordan Times, Vol. 39, No. 11821, p. 9.

The Jordan Times, September 11, 2014. **PARLIMENT: 40 MPs reject plan to import Israeli gas.** The Jordan Times, Vol. 39, No. 11823, p.1&13.

Ghazal, Mohammad, September 7, 2014. **ENERGY: Jordan mulls gas imports from Cyprus.** The Jordan Times, Vol. 39, No. 11819, p. 1.

Ghazal, Mohammad, September 10, 2014. **ENERGY: Jordan, Cyprus to work on gas deal details 'within weeks'.** The Jordan Times, Vol. 39, No. 11822, p. 1. Minister of Energy & Mineral Resources, National Electric Power Company (NEPCO), Noble Energy, British Gas Group.

The Jordan Times, August 15, 2014. **AT A GLANCE: National Petroleum Company to continue gas exploration to Risheh - Hamed.** The Jordan Times, Vol. 39, No. 11780, p. 3.

Ghazal, Mohammad, September 4, 2014. **ENERGY: Electricity company to buy gas from Israel - Letter of intent signed, official agreement due in November.** The Jordan Times, Vol. 39, No. 11817, p.1. Per state-owned National Electric Power Company (NEPCO), and Ministry of Energy and Mineral Resources, with the American company Noble Energy.

Abu-Hamattah, Z.S.H., Khitam Al-Zughoul and Saleh Al-Jufout, 2011. **Potential Geothermal Energy Utilization in Jordan: Possible Electrical Power Generation.** Int. J. of Thermal & Environmental Engineering, 3(2011) 9-14.

Mansour, Yusuf, September 9, 2014. **OPINION & ANALYSIS: Gas from Israel.** The Jordan Times, Vol. 39, No. 11821, p. 9.

Ghazal, Mohammad, September 4-6, 2014. **Gov't approves agreement for oil shale power plant - Deals to be signed soon - energy minister.** The Jordan Times, Vol. 39, No. 11818. p. 3.

Ghazal, Mohammad, August 18, 2014. **"Gov in final stages of preparing deals for oil shale power plant' – two out of four agreements ready for project - minister.** The

Namrouqa, Hana, August 22-23, 2014. **Environment: Greenpeace launches campaign to highlight nuclear energy alternative.** The Jordan Times, Vol. 39, No. 11806, p. 2.

Sunroofs and sloped-roofs/ awning overhangs to capture natural daylight without heat

Capture food wastes and convert them to methane/ energy and/or for compost

Capture waste materials – metals, glass, paper, etc. for reuse/ recycling – may be energy hogs

Soft demolition and construction materials and household/ architectural materials for collection, reuse and recycling

Recognize that water, energy and solid-waste management are intimately connected and cross-linked, with impacts from one to another. There are tradeoffs to consider as improvements in one might positively or negatively impact others, as well as social and economic impacts to civil society, democracy and governance, health and sanitation, environmental quality, pollution prevention and environmental improvements and degradation, labor, and so on. It's best to run a holistic evaluation and to ultimately choose practices which do the least harm, are simple and quickly beneficial to be models for success and confidence building.

Identify your target audience and research 360° influences on them, and what motivates their behavior. Be careful to sub-target, ex. West Amman is very different from East Amman households, both are different from Aqaba and all are different from rural and smaller-town folks in the governorates; housewives are different from business women; bill payers different from free-loaders; students and youth different from all. Some respond to lower bills, prestige, style and fashion, regulations and enforcement, sense of equity and fairness, national and family pride, awards and cash prizes, peer respect, being seen on TV with movie stars and authority figures, etc. Some people see the aesthetic, commercial and practical art and designs possible with recycled materials. Others take architectural, engineering, commercial and household advantage of resources recovered from soft building demolition. Some may benefit from waste-to-resources materials exchanges. It's really important to understand this.

Look at successful models like USGBC's Leadership in Environmental and Energy Design (LEED), International Organization of Standards (ISO) 14000, Green Key, Alameda County Waste Management Authority (ACWMA), California Integrated Waste Management Board (CIWMB), Solid Waste Association of North America (SWANA), International Council on Local Environmental Initiatives (ICLEA), Zabelenes in Cairo, Emirates Environmental Group (EEG) in Dubai, Singapore Ministry of the Environment (SMOE), etc.

Sponsor water, energy and solid waste consumer-to-consumer information exchanges, workshops, fairs, demonstrations with invited vendors and suppliers; establish urban water, energy and solid wastes centers to show ongoing exhibits related to cost savings, aesthetics, national pride, etc.

For non-agricultural and non-industrial water:

- Expand USAID-funded public action plans (PAP) for social marketing and technical equipment distribution
- Expand to community/ neighborhood rooftop, street and parking lot rain-water harvesting for landscaping and other non-potable uses like street watering for dust control
- Follow plumbing codes for retrofits and new construction – see if the codes need updating
- Offer significant gifts, grants, awards for water-saving, conservation, reuse, etc. ideas and equipment; ex. There are now simple bathroom boxes which will take grey water from sinks and funnel it to flushing toilets. There is now water-less toilets.
- Give grants, loans and other incentives like tax breaks and refunds to SMEs, NGOs, CBOs and others to do things like water audits, finding and fixing water distribution leaks, replacing water-wasting equipment with low-flow faucets and shower heads, etc., as well as related business concepts
- Demonstrate cost saving behavior and equipment on water bills
- For hotels, promote green choices, LEED, laundry/ bedding/ towels greener use

For non-agricultural and non-industrial energy:

- Expand USAID-funded PAP social marketing and technical equipment distribution
- Apply the principles of Urban Heat Island mitigation to reduce ambient air temperatures by a few degrees and reducing air conditioning energy demand – narrow streets; shade trees (but not the kind

that produce volatile organic compounds or litter or berries or acids); ramadas, awnings and covers for open areas; white roofs, streets and parking lots

- Provide incentives for energy efficient appliances, lights, awnings and shade, comfort regulators (HVAC limits/ controls to be in a lower energy consuming range)
- Give grants, loans and other incentives like tax breaks and refunds to SMEs, NGOs, CBOs and others to do things like energy audits, finding and fixing energy losses, replacing energy-wasting equipment with low-energy demand, etc., as well as related business concepts
- Demonstrate cost saving behavior and equipment on electricity bills
- For hotels, promote green choices, LEED, laundry/ bedding/ towels greener use

For non-agricultural and non-industrial solid waste:

- Source separate inorganic from organic wastes
- Capture organic wastes (food wastes, landscape litter, animal wastes, crop residues) and convert to sustainable, renewable methane gas for energy and/or compost for landscaping or crop soil-amendments or fertilizers to replace imported fuels, mined and refined oil and gas, and imported compost and fertilizer
- Capture valuable, marketable inorganics – metals, glass, plastics, paper/ cardboard for recycling
- In offices, segregate paper for reuse as notepaper or pads and/or sell to paper recyclers – replace laser printers which destroy paper fibers with bubble jet printers which make bubble-jetted waste paper easy to recycle
- Promote building, neighborhood and community drives/ campaigns in Smart Shopper programs, 3R's – reduce-reuse-recycle
- Establish soft demolition ordinances and support architectural and construction demolition materials shops like Urban Ore
- Convert solid waste landfill to sustainable, never-fill up methane plants
- Support thrift shops (*secundarias*, used clothing and furniture shops) through grants, loans, tax breaks, advertising – some have great names, like “First Choice, Second Hand,” “Rough ‘n Ready,” “Urban Ore”
- Provide incentives for waste motor oil recovery and recycling, waste-to-resources exchanges, waste bins for separation, etc.
- Give grants, loans and other incentives like tax breaks and refunds to SMEs, NGOs, CBOs and others to do things like waste audits, clean and dirty materials recovery facilities (MRF) – hire scavengers for this, as well as related business concepts
- Demonstrate cost saving behavior and equipment on trash bills
- For hotels, promote green choices, LEED, metals recovery, organic waste to methane, greener use
- For commercial and industrial, set up linkages for soft demolition, construction debris, other waste products/ resource exchanges
- For household and other hazardous wastes, establish drop-off centers that properly reuse, recycle, treat or dispose – lots of paint and other chemicals otherwise are disposed to the environment to degrade it and human and habitat life which could be simply reused as paint, etc. by NGOs, etc.

Guide to Household and Institutional Wise Water, Energy and Solid-Waste Equipment

Linkages

- Pumped water needs energy and may be contaminated from solid waste
- Manufactured energy needs water and generates solid waste
- Solid waste may contaminate water, pose health and ecological threats, but is energy and cash-resources rich

- Bill-payers, housewives, and youth play leading roles in water, energy and solid-waste management

Basic principles

The classic 3R's: reduce, reuse, and recycle... compost... energy

Reduce - Buy less, use less, dispose/ waste less

Reuse - Use something again in the same way as intended, which otherwise is waste

Recycle - Use an item made from materials modified or reformulated from otherwise waste

Compost - Make fertilizer or soil amendment from organic wastes (food, sewage biosolids (sludge), agricultural processing residues, crop residues, forest litter, landscape trimmings)

Waste-to-energy - Make methane from organic wastes

Wise strategies/ equipment

Water - Strategies: Rationing; command and control regulations/ enforcement; Slow the flow; Beat the peak; Yellow Mellow/ Brown Flush-Down Messaging; Find and fix the leaks; Reminder signs; Outreach campaigns; water use audits; contests/ awards; USGBC LEED; ISO 14000; modernize plumbing and construction codes, regulations, ordinances; pricing with incentives

- Equipment: Metering; water-flow faucet/ tap restrictors and aerators; sensor-activated faucets/ taps; leak test detection dyes/ fixers; recovery/ reuse systems for gray water/ rooftop water/ street runoff water; smaller toilet tanks or tank fillers; dual flush toilets; waterless toilets; automatic timers/ water shut-off switches; automated landscape irrigation controls; xerophyte and rock landscaping

Energy - Strategies: Rationing, command and control regulations/ enforcement; energy-use audits; contests/ awards; USGBC LEED; ISO 14000; modernize energy and construction codes, regulations, ordinances; pricing with incentives

- Equipment: Metering; energy-efficient appliances/ electronics/ lights, photovoltaic cells/ solar panels for water heating/ pumping/ energy generation; use natural processes for hot air flow venting with wind towers/ false roofs; air-dry clothing; window films and protective curtains; sunroofs and natural sunlight; louvered windows to increase indoor air flow by passive cooling; roof overhangs to let in lighting but not solar heat; awnings, tents, covers, ramadas, overhangs, recessed windows and door, lamp and heating controls and intelligent monitoring controls; shading (including awnings, ramadas, tents, shade trees) and white roofs, streets and parking areas to reduce urban heat island (UHI) effect



Same Suleiman street facing west at 4:30 p.m., 14 September 2014. The “open” walk on the right is hotter with its building needing more electrical energy for air conditioning than the “shaded” walk on the left, according to urban heat island mitigation principles.

Solid Waste - Strategies: 3R's campaigns; Smart Shopper Campaigns (Buy Less/ Smaller – Discard Less); anti-littering campaigns; Urban Ore; Soft demotion; thrift and secondhand shops; command and control regulations/ enforcement; solid-waste audits; contests/ awards; grants to entrepreneurs; CBOs, NBOs for business startups; USGBC LEED; ISO 14000; waste-to-resource clearinghouses; modernize energy and construction codes, regulations, ordinances; support commodities brokers; pricing and price-reduction incentives for 3R's

- Equipment: Metering; building or community waste bins; waste-source separation trash containers/ bins; dirty and clean materials recovery facilities (MRF); metals (especially iron, copper, aluminum, lead), collet (glass), wood and wood chips, porcelain refinishing, plastic, paper/ cardboard recycling equipment; composting facilities; waste-to-energy plants

Tips for Social Marketing Training

See tips from Vance, David L., 2010. *Learning: How to Manage Corporate Training to Improve Your Bottom Line*. Poudre River Press

- Adopt a hardheaded business approach – strategic planning and rigorous execution – so it can make a significant impact
- Set up the same type of discipline, measuring goals that corporate units use when they establish their performance objectives
- Develop a business plan that details the strategy and actions you plan to undertake next year
- Create a mission statement of your purpose and a vision statement as aspirational declaration about what you want to achieve
- Prepare regular reports and scorecards – special purpose reports with selected data that measure your progress
- Explain the explicit benefits
- Adopt a strategic focus
- Create a vision mission statement
- Create a 5-year plan to achieve your vision
- Adopt an evaluation strategy
- Benchmark with data

Additional Tips

- Essay contests, themes – More water from less, Energy use, Cash in trash, Five practical ways to save water/ save energy/ reuse trash
- Graphics games
- Connect and circle the letters that spell important waste strategies or resources, like 3Rs, reduce, reuse, recycle, compost, methane, cardboard, concrete, asphalt, rubber, aluminum, copper, iron, zinc, lead, paper, plastic, paint, bottles, jars, leather, pallets, motor oil, furniture, cooking oil, grease, automobile parts, appliances, tools, kitchenware, dishes, utensils, clothes, etc.
- Crossword puzzles
- Phrases that rhyme
- Sentences with (fill-in the missing key word)
- Connect/ circle
- Essay contests with significant prizes. Themes like: More water from less; Smart energy use; Cash in trash; Five practical ways to save water, energy and reuse trash

Highlighting Technical Challenges/ Limitations in Water- and Energy- Saving Equipment

There are several technological challenges or limitations in water- and energy- saving equipment. This is especially true where there may not be trained technicians to monitor, repair and maintain; where initial capital cost is more important than life-cycle costs in purchase decisions, and where electrical currents may spike beyond equipment-operations specifications. Among these challenges and limitations are:

Water and energy meters may be damaged, nonfunctional, miss-calibrated, incorrectly read and recorded, and billed out improperly

It may be difficult to install some water- and energy- saving devices in existing buildings or structures without tinkering, retrofitting, renovation or reconstruction; ex. CFBs, LCDs, gray water and rooftop water systems, solar water heaters, heat-exhaust pumps, natural air circulation towers

There may be less consumer interest in replacing lower-use devices where existing devices are in-place, functional, paid for, and familiar; ex. new toilets, faucets, light fixtures, appliances and electronics, solar water heaters, HVAC, CFBs, LCDs, light dimmers

Some equipment needs maintenance and repairs, and the human technical capacity to perform them; ex. gray water and rooftop water pumps, heat-exhaust pumps, solar PV collectors or panels, meters

Some equipment may be poor quality with short and even unsafe operational life; ex. meters, faucets, aerators, flow restrictors, solar PV collectors or panels, water pumps, heat-exhaust pumps, HVACs, pipes, valves, wiring, extension cords and strips

Some equipment may be improperly labeled and over-rated; ex. CFBs, LCDs, flow restrictors, meters, faucets, aerators, appliances, electronics, water pumps, heat-exhaust pumps, solar PV collectors or panels

Some outdoor or unprotected equipment may be vandalized or stolen; ex. meters, water pumps, solar PV collectors and panels, water storage tanks and barrels, garbage bins, CFBs, LCDs

Some equipment may not operate as designed due to dust or sediment accumulation (ex. solar PV collectors and panels, and solar water heaters) or due to incompatible electrical current (ex. appliances, HVACs, electronics)

Solar energy systems which convert direct current to alternating current, or store generated electricity in batteries, may contain or release hazardous acids and fumes

RECOMMENDATIONS: Do's

Role of government and decentralization

Design, write, promote and enforce regulations, rules, ordinances to promote environmentally sound practices, such as water demand management, conservation and reuse, and non-revenue water reduction and leak detection and repairs; energy demand management; waste source separation, 3R's, waste-to-energy, waste-to-compost, soft demolition, urban heat island mitigation, anti-literary, etc.

Some Jordanian government policies are not feasible or unwise, or not sustainable. Some may be thoughtlessly promoted by well-intended but not knowledgeable foreign donors. For example:

- Announce plans in the Jordanian Times to establish a 2,100-ha forest will add to the country's water demand and may die off if not frequently irrigated.
- Environmental policy to incinerate solid waste, which increases energy demand, need extensive operations and maintenance, and repairs, and loses the opportunity to capture wealth from organic wastes while it converts a solid waste to an air pollution hazard, per the MoENV environmental strategic plan
- National push towards solar photovoltaic cell panels may require a high and new water demand to wash off the accumulated dust, and create water pollution
- Environmental command-and-control laws, regulations, policies, bans, etc. that are not enforced or implemented are ineffective, though donors may insist on them.

His Majesty King Abdullah said, "When I began to visit the provinces it seemed to me that the citizen is one who knows the priorities for his district." Qashou, Hazem, September 14, 2014. **OPINION & ANALYSIS: Decentralisation leads to development.** The Jordan Times, Vol. 39, No. 11825, p. 8.

Role of investors

Private and government investors could be mobilized to invest in competitive and innovative water, energy, and waste management projects given the right incentives.

Raising awareness

The Jordan Times, August 28, 2014. AT A GLANCE: **Prince Hassan inaugurates Sawsana Environmental Programme.** Vol. 39, No. 11811, p. 2.

The Jordan Times, August 23, 2014. **BUSINESS CLUB: King Hussein Bin Talal Convention Centre celebrates World Environment Day.** The Jordan Times, Vol. 39, No. 11808, p. 11. Hilton

Employment opportunities

Unemployment is high in Jordan, especially for youth. This degrades economic development, and regionally may contribute to social unrest leading to revolution as in the 2011 Arab Spring, or to migration to other countries for work, creating a brain-drain.

The Jordan Times, August 19, 2014. **EDITORIAL & OPINION: Serious [Youth Unemployment] problem that needs redress.** The Jordan Times, Vol. 39, No. 11803, p. 8.

The Jordan Times, September 14, 2014. **AT A GLANCE: Around 40,000 Jordanians reside in Qatar.** The Jordan Times, Vol. 39, No. 11825, p. 4.

Role of donors

There are numerous local, regional, and international donors are active in Jordan. These include, for example: Ajib Bank, Arab Bank, Bank of Jordan, European Community, Jordan Potash, Jordan Islamic Bank, Princess Alia Foundation, The King Abdhullah II Fund for Development (KAJD), Jordanian Hashemite Fund for Human Development (JOHUD), Kuwaiti Fund for Arab Economic Development (KFAED), Saudi Fund for Development (SAMIRAD), Zain Telecon, American Children's Museum Association (ACMA), Columbia University Teachers College (CUTC), Sesame Street Workshop, British Council, German Development Bank (KfW), Italian Embassy, Japan International Cooperation Agency (JICA), Japanese Trust Fund, Spanish Embassy, Swedish International Development Agency (Sida), Turkish Embassy, United Kingdom, European Bank for Reconstruction and Development (EBRD), International Committee of the Red Cross (ICRC), U.S. Agency for International Development (USAID), U.S. Millennium Challenge Corporation (MCC), World Bank's International Monetary Fund (IMF), United Nations (UN) several children's, development, environment, health, refugee and other agencies

The Jordan Times, August 19, 2014. **AT A GLANCE: Jordan needs international assistance to cope with Syrian crisis - Majali.** The Jordan Times, Tuesday, Vol. 39, No. 11803, p. 2.

Role of volunteers

The Jordan Times, August 28, 2014. **AT A GLANCE: Fund to go ahead with third phase of project to promote volunteerism.** Vol. 39, No. 11811, p. 3.

Role of women

The Jordan Times, August 19, 2014. **AT A GLANCE: Gender equality still low in the in the workplace - report.** The Jordan Times, Vol. 39, No. 11803, p. 3.

Alkhadra, Wafa A., September 15, 2014. **OPINION & ANALYSIS: The need for a paradigm shift in gender perception.** The Jordan Times, Vol. 39, No. 11826, p. 9.

Belsito, Giuseppe, September 4, 2014. **OPINION: Women and decision making.** The Jordan Times, Vol. 39, No. 11817, p. 9.

Social Marketing

Fund activities which follow social marketing strategies: researching target audiences and their motivators; designing campaigns which provide environmentally sound designs, distribute knowledge and information, develop social and outreach skills, enlist the support of women and youth and bill payers and religiously and job motivated persons; distribute practical and meaningful technologies, encourage the beneficiaries to

develop and implement activities they design if appropriate and do not create more energy and water demands or generate more waste.

Fund activities which assure the implementers understand that social marketing is more than social media and customer service.

Success

Assure that implementers are meeting indicators which are designed to measure effectiveness and sustainability.

Water

The Jordan Times, August 28, 2014. ***AT A GLANCE: Authorities remove illegal pipes installed on badia water mains.*** Vol. 39, No. 11811, p. 2.

Energy

Sort, capture, and use organic waste from household and restaurant food waste, agricultural and landscaping crop residues, animal waste, and wastewater bio-solids (slugged) to generate sustainable energy as methane gas to replace imported diesel and LPG, and/or to manufacture compost for soil fertilizers and soil amendments.

Investigate the financial and resource suitability in developing solar, wind, geothermal, petroleum oil and gas, and oil shale, noting that solar collectors do not work when dust-covered and requires water-cleaning, grid-distributed energy requires sufficient grid capacity, and geothermal, oil and gas, and oil shale generate solid waste, may pollute resources, and have high water and energy demands

Fund activities which mitigate urban heat island effects which raise urban ambient air temperature, adversely affect human comfort and health, and raise energy demands for air conditioning of buildings. Such activities include: narrowing streets; whitening rooftops, streets and parking lots; using mass transit buses and vans; community by bicycle and mass transit; walking to work; working near home, at nearby or satellite offices, or from home, and telecommunicating and Skyping; combining errands and trips with a car and car pooling.

RECOMMENDATIONS: Don't's

Avoid funding activities which create unsustainable water demands, energy sources, and operations and maintenance, such as landscape gardens and forests without a secured irrigation water supply.

Conclusion

The immediate to long-term solutions for Jordan's water, energy and solid-waste challenges are politically, culturally, economically, and technically challenging. Briefly, they must include continued and improved social marketing campaigns with expansion to larger water and energy consumers and solid-waste generators as well as bolder and more innovative policies in tangible incentives. Population control and refugee limitations are infeasible, so the challenges are in fact immediate and emergency level national crises.

Some key components of long-term solutions include:

- Improved social marketing, water and energy conservation, co-energy generation, artificial groundwater recharge and treated wastewater recharge basins and dry surface reservoirs
- Transnational water and energy cooperation and transfers
- Exploration and development of national water and energy resources, including deep groundwater, desalination of mineralized springs and well water, wastewater collection and treatment and reuse, and of course tapping national wind, solar, oil and gas, and geothermal resources
- More expensively, there are geothermal and hydropower opportunities, nuclear energy, and the Red-Dead and/or Med-Dead water and energy potential
- Solid-waste will need the infrastructure, laws, regulations, ordinances, and incentives with public support to reduce, reuse, recycle, compost and waste-to-energy initiatives from what is now considered disposal trash or garbage
- Energy generation from organic wastes such as food wastes, crop residues, and wastewater treatment plant biosolids or sludges to methane gas as a sustainable renewable energy source

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Annex 1. Good, Better, Best Water, Energy and Solid-Waste Management Technologies

Assigning judgments or rankings to various water-, energy- and solid-waste management devices, equipment, machinery, tools and so on is subject to debate and disagreement by administrators, financial managers, engineers, technicians, lay persons, donors, stakeholders, beneficiaries, and others. In addition, there are trade-offs, as various technologies require various levels of operational and maintenance capacities, spare parts, and demands on other resources. Nonetheless, it is useful to see what can be done with these technologies by their sectors.

Water

Water Meters		
Good	Better	Best
Analogue	Digital	Digital Remote
Low cost	Moderate cost	High cost
Difficult to read; easy to misread; needs on-site meter reader	Easy to read and record; needs on-site meter reader	Most accurate; automatic read and record; no on-site meter reader needed; requires sophisticated network

Faucet Aerators - Pipe Flow Reducers - Automatic Turn-off		
Good	Better	Best
Faucet Aerators/ Bubblers	Pipe Flow Reducers/ Restrictors	Automatic turn-off or timed faucets
Low cost	Moderate Cost	High cost
Easy to install and replace by lay persons	Requires plumber to install	Most water-saving; requires plumber to install

Condensate Collection - Rooftop Water Collection - Gray Water Collection		
Good	Better	Best
Air Conditioner Condensate	Rooftop Water	Gray Water
Low cost	Moderate cost	High Cost
Sustainable supply; easy to install; high-quality water for potable use	Only available when it rains; may require plumber to install; water may be cloudy, turbid; suitable for landscaping and car washing; easily treated by sand or carbon filtration for potable use	Sustainable supply; may require plumber to install and space demands; water may be cloudy, turbid, soapy, bacterial; suitable for landscaping and car washing; easily treated by sand or carbon filtration for potable use

Toilet Dye Test/ Bag-Tank Reducer - Duel-Flush Toilet - Smaller-Tank Toilet		
Good	Better	Best
Toilet Dye Test/ Bag-Tank Reducer	Duel-Flush Toilet	Smaller-Tank Toilet
Low cost	Moderate cost	Moderate Cost
Easy to test for tank leaks; easy to insert bag in tank to reduce flush volume; consumer-friendly	Needs plumber to install; some consumers may not know how to use it; good water savings if/ only used properly	Needs plumber to install; consumer-friendly; routinely saves water without any thought

Flood - Sprinkler - Drip Landscape Irrigation		
Good	Better	Best
Flood	Sprinkler	Drip
Low cost	Moderate Cost	High cost
Easy to use; wastes water if it irrigates open areas without plant roots	May require plumber to install; easy to use; wastes water to evaporation and if it irrigates open areas without plant roots	May require plumber to install; easy to use; may need water treatment to remove sediment/ turbidity; may need repairs from animal or frost damage; saves the most water when used properly to water plant roots, especially trees and shrubs

Energy

Electrical Meters		
Good	Better	Best
Analogue	Digital	Digital Remote
Low cost	Moderate cost	High cost
Difficult to read; easy to misread; needs on-site meter reader	Easy to read and record; needs on-site meter reader	Most accurate; automatic read and record; no on-site meter reader needed; requires sophisticated network

Compact Fluorescent Bulbs (CFB) - Liquid Crystal Display (LCD) - Lighting Dimmers		
Good	Good	Good
Compact Fluorescent Bulbs	Liquid Crystal Display	Lighting Dimmers
Moderate cost	Moderate cost	Low cost
Great energy saver; easy to install; may not fit in all light fixture; may not be aesthetically pleasing	Best for signs and small-area highlight lighting; may not fit all light fixtures	May require electrician to install; great energy saver and mood setter

Solar Water Heaters (SWH) - Solar Clothes Dryers (SCD) - Solar Panels (Photovoltaic Cells) for Energy Generation		
Good	Good	Good
Solar Water Heaters (SWH)	Solar Clothes Dryers (SCD)	Solar Panels (Photovoltaic Cells) for Energy Generation
Moderate cost	Low cost	High cost
Great energy saver; may require plumber to install; may not fit in all spaces; very dependable when sized properly; hard (calcium-rich) water may clog piping	Great energy saver; easy to use	Great energy saver; requires installation specialist; may not function if panels become dusty; needs inverter from direct to alternating current for most appliance; if acid storage batteries are required, these may leak or expose people and the environment to hazardous liquids and gases

Heat-Exhaust Pumps - Heat-Exhaust Rooftop Turbines - Passive Heat-Exhaust Ventilation - Wall Heat-Exhaust Vents - Room/ Space Heaters/ HVAC Units - Heater/ HVAC Controls					
Heat-Exhaust Pumps	Heat-Exhaust Rooftop Turbines	Passive Heat-Exhaust Ventilation	Wall Heat-Exhaust Vents	Room/ Space Heaters/ HVAC Units	Heater/ HVAC Controls
Good	Good	Good	Good	Good	Good
Moderate cost	Low cost	Low cost	Very low cost	Moderate cost	Very low cost
Requires electrician to install; runs off electricity	Requires carpenter to install; runs off natural wind	Requires carpenter to install; runs off natural hot-air rising	Requires carpenter to install; runs off natural wind	Consumer can install space heater; space HVAC requires electrician to install; both run off electricity	If manual, depends on user; if automatic, can be set to assure least-energy demand mode

Indoor and Outdoor Shadings				
Good	Good	Good	Good	Good
Outdoor Awnings, Ramadas, Coverings	Window Double Panes	Louvered Windows	Window Coverings, Curtains, Blinds, Films	Rooftop Skylights/ Skylight Windows
Low to moderate cost	Moderate to Expensive cost	Moderate cost	Low to moderate cost	High cost
Requires carpenter to install; cooling areas near buildings reduces building temperature and AC costs, and urban heat island	Requires carpenter to install; heating and cooling energy demand	Requires carpenter to install; cools naturally and reduces energy demand	Easy to install; reduces heating and cooling energy demand	Requires carpenter to install; reduces electrical energy for lighting

Solid Waste

Solid Waste Bins and Processing Systems			
Good	Better	Best	Best
Waste Bins	Source-Separation Bins	Composting Bins and Systems	Waste-to-Energy Systems
Low cost	Moderate cost	Moderate cost	Moderate to high Cost
Easy to install; reduces street dumping and litter	Easy to install; prepares waste for resource recovery if there are linkages to commodity brokers	Easy to install and operate; makes fertilizers and soil amendments from organic and landscape wastes for commercial and other uses	Moderately easy to install and operate; makes methane or bio-gas from organic and landscape wastes, and wastewater treatment plant bio-solids (sludges) for commercial or other energy use